CLAIMS

What is claimed is:

1. A method for detecting an endpoint of a chemical mechanical planarization (CMP) process comprising the steps of:

providing a light pulse on an area of a surface of a semiconductor wafer;

receiving light reflected from said area of said surface;

analyzing a reflectance spectra; and

repeating said steps listed hereinabove until an intermediate reflectance spectra is identified that has a sinusoidal shape when normalized.

2. The method for detecting an endpoint of a chemical mechanical planarization (CMP) process as recited in claim 1 further including the steps of:

identifying a change in said reflectance spectra corresponding to a layer of material being removed from said surface by the chemical mechanical planarization process and an underlying layer of a different material is exposed; and

stopping the chemical mechanical planarization process.

3. The method for detecting an endpoint of a chemical mechanical planarization (CMP) process as recited in claim 2 wherein said step of identifying a change in said reflectance spectra corresponding to a layer of material being removed from said surface by the chemical mechanical planarization process and an underlying layer of a different material is exposed further includes a step of overpolishing for a predetermined time period to ensure said layer of material is removed..

4. The method for detecting an endpoint of a chemical mechanical planarization (CMP) process as recited in claim 1 further includes the steps of:

continuing the chemical mechanical planarization process for a predetermined time period; and

stopping the chemical mechanical planarization process after said predetermined time period.

5. The method for detecting an endpoint of a chemical mechanical planarization (CMP) process as recited in claim 1 wherein said step of providing a light pulse on an area of a surface of a semiconductor wafer further includes using a broadband spectrum of light such that an intensity of said reflected light is analyzed over a plurality of wavelengths.

6. The method for detecting an endpoint of a chemical mechanical planarization (CMP) process as recited in claim 5 wherein said step of using a broadband spectrum of light such that an intensity of said reflected light is analyzed over a plurality of wavelengths further includes a step of providing light in a range of 300 to 800 nanometers in wavelength.

7. The method for detecting an endpoint of a chemical mechanical planarization (CMP) process as recited in claim 1 wherein in said step of analyzing a reflectance spectra further includes a step of performing a fast fourier transform analysis on said reflectance spectra.

8. The method for detecting an endpoint of a chemical mechanical planarization (CMP) process as recited in claim 1 wherein said step of repeating said steps listed hereinabove until an intermediate reflectance spectra is identified that has a sinusoidal shape when normalized further includes the steps of:

varying a location of said light pulse on said surface of said wafer; and

taking a diversity of reflectance spectra over time such that an entire surface of said semiconductor wafer is represented by said measurements in determining material uniformity, thickness, and removal rate.

9. The method for detecting an endpoint of a chemical mechanical planarization (CMP) process as recited in claim 1 wherein said step of providing a light pulse on an area of a surface of a semiconductor wafer further includes a step of providing said light pulse for a time period of approximately ten microseconds or less.

10. The method for detecting an endpoint of a chemical mechanical planarization (CMP) process as recited in claim 1 wherein said step of providing a light pulse on an area of a surface of a semiconductor wafer further includes a step of providing said light pulse having a spot size larger than a largest feature size to remain on said semiconductor wafer after the CMP process.

11. The method for detecting an endpoint of a chemical mechanical planarization (CMP) process as recited in claim 1 wherein said step of providing a light pulse on an area of a surface of a semiconductor wafer further includes a step of using more than one probe to pulse and receive light.

12. The method for detecting an endpoint of a chemical mechanical planarization (CMP) process as recited in claim 11 wherein said step of using more than one probe to pulse and receive light further includes the steps of:

using more than one probe to pulse and receive light such that each probe measures a concentric band on said surface and said concentric bands measured by each probe combine to represent an entire surface of said semiconductor wafer; and

overlapping measurements of each probe to an adjacent concentric band.

13. A method for detecting an endpoint of a chemical mechanical planarization (CMP) process comprising the steps of:

taking reflectance spectra data periodically on different areas of a surface of a semiconductor wafer during the CMP process;

identifying a first reflectance spectra corresponding to a first layer of material on a surface of a semiconductor wafer such that said first reflectance spectra comprises light reflected predominately from said first layer of material;

identifying a second reflectance spectra corresponding to said first layer of material on said surface being thinned such that said second reflectance spectra is modified by a second layer of material underlying said first layer of material; and

identifying a third reflectance spectra corresponding to said first layer of material on said surface being substantially removed such that said third reflectance spectra comprises light reflected predominately from said second layer of material.

14. The method for detecting an endpoint of a chemical mechanical planarization (CMP) process as recited in claim 13 wherein said step of taking reflectance spectra data periodically on different areas of a surface of a semiconductor wafer during the CMP process further includes a step of using a broadband spectrum of light ranging from 300 to 800 nanometers in wavelength to generate said reflectance spectra data.

15. The method for detecting an endpoint of a chemical mechanical planarization (CMP) process as recited in claim 13 further including the steps of:

normalizing said reflectance spectra data to said first reflectance spectra; and

identifying when said normalized reflectance spectra data changes from an approximately linear shape to an approximately sinusoidal shape that corresponds to said second reflectance spectra.

16. The method for detecting an endpoint of a chemical mechanical planarization (CMP) process as recited in claim 15 further including the steps of:

continuing the CMP process for a predetermined time period; and

ending the CMP process after said predetermined time period.

17. The method for detecting an endpoint of a chemical mechanical planarization (CMP) process as recited in claim 15 further including the steps of:

identifying when said normalized reflectance spectra data changes from said approximately sinusoidal shape to an approximately linear shape that corresponds to said third reflectance spectra data;

overpolishing for a predetermined time period; and

ending the CMP process after said predetermined time period.

18. A method of wafer processing including end point detection for a chemical mechanical planarization process (CMP) comprising the steps of:

forming at least one trench in a dielectric layer;

depositing a barrier material on a surface of a semiconductor wafer such that said barrier material forms a layer on a bottom and sidewalls of said at least one trench;

depositing copper on said surface of the semiconductor wafer such that said at least one trench is filled with copper;

performing a first CMP process to remove a layer of copper on said surface of the semiconductor wafer such that said copper remains in said at least one trench;

initiating a second CMP process to remove said layer of barrier material on said surface of the semiconductor wafer;

taking reflectance spectra data on different areas of said surface of said semiconductor wafer using a broadband spectrum of light ranging from 300 nanometers to 800 nanometers in wavelength;

identifying when said barrier metal has been thinned such that said reflectance spectra data is modified by said dielectric layer underlying said barrier layer; and

continuing with said second CMP process knowing an approximate thickness of said barrier layer that remains.

19. The method of manufacturing as recited in claim 18 further including a step of:

identifying when said reflectance spectra data corresponds to reflected light predominately from said dielectric layer; and

overpolishing to ensure complete removal of said barrier material on said surface of the semiconductor wafer.

20. The method of manufacturing as recited in claim 18 wherein said step of depositing a barrier metal on a surface of a semiconductor wafer such that said barrier metal forms a layer on a bottom and sidewalls of said at least one trench further includes a step of depositing tantalum as said barrier material.

21. The method of manufacturing as recited in claim 18 wherein said step of depositing a barrier metal on a surface of a semiconductor wafer such that said barrier metal forms a layer on a bottom and side walls of said at least one trench further includes a step of depositing tantalum nitride as said barrier material.